



7N65-ML

Power MOSFET

7A, 650V N-CHANNEL POWER MOSFET

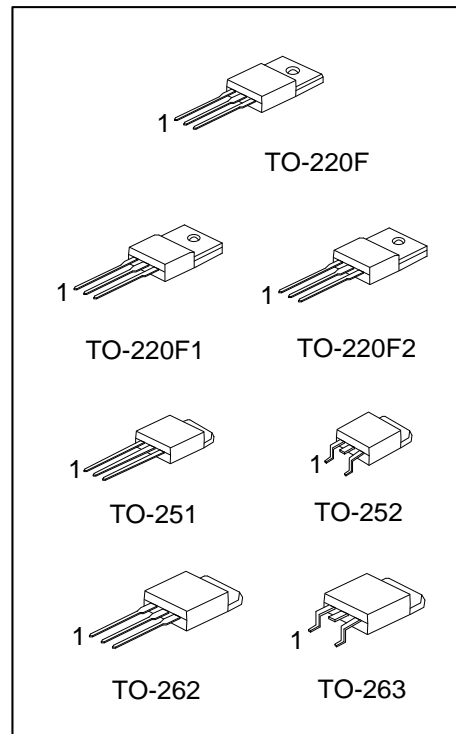
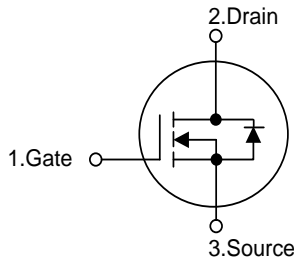
DESCRIPTION

The UTC 7N65-ML is a high voltage power MOSFET combines advanced trench MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.

FEATURES

- * $R_{DS(ON)} \leq 1.3 \Omega @ V_{GS}=10V, I_D=3.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

SYMBOL



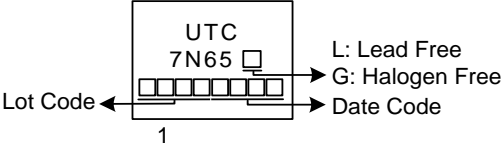
ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|--------------|----------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 7N65L-TF1-T | 7N65G-TF1-T | TO-220F1 | G | D | S | Tube |
| 7N65L-TF2-T | 7N65G-TF2-T | TO-220F2 | G | D | S | Tube |
| 7N65L-TF3-T | 7N65G-TF3-T | TO-220F | G | D | S | Tube |
| 7N65L-TM3-T | 7N65G-TM3-T | TO-251 | G | D | S | Tube |
| 7N65L-TN3-R | 7N65G-TN3-R | TO-252 | G | D | S | Tape Reel |
| 7N65L-T2Q-T | 7N65G-T2Q-T | TO-262 | G | D | S | Tube |
| 7N65L-TQ2-T | 7N65G-TQ2-T | TO-263 | G | D | S | Tube |
| 7N65L-TQ2-R | 7N65G-TQ2-R | TO-263 | G | D | S | Tape Reel |

Note: Pin Assignment: G: Gate D: Drain S: Source

| | |
|---|---|
| <p>7N65G-TF1-T</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p> | <p>(1) T: Tube, R: Tape Reel (2) TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F TM3: TO-251, TN3: TO-252, T2Q: TO-262 TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---|---|

MARKING



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■ **ABSOLUTE MAXIMUM RATINGS** ($T_C=25^{\circ}\text{C}$, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|------------------------------------|------------------------------|-----------|------------|--------------------|
| Drain-Source Voltage | | V_{DSS} | 650 | V |
| Gate-Source Voltage | | V_{GSS} | ± 30 | V |
| Continuous Drain Current | | I_D | 7 | A |
| Pulsed Drain Current (Note 2) | | I_{DM} | 14 | A |
| Avalanche Energy | Single Pulsed (Note 3) | E_{AS} | 281.3 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 2.3 | V/ns |
| Power Dissipation | TO-220F/TO-220F1 TO-220F2 | P_D | 35 | W |
| | TO-251/TO-252 | | 48 | W |
| | TO-262/TO-263 | | 125 | W |
| Junction Temperature | | T_J | +150 | $^{\circ}\text{C}$ |
| Storage Temperature | | T_{STG} | -55 ~ +150 | $^{\circ}\text{C}$ |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. $L = 10\text{mH}$, $I_{AS} = 7.5\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^{\circ}\text{C}$

4. $I_{SD} \leq 7.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

| PARAMETER | | SYMBOL | RATING | UNIT |
|---------------------|---|---------------|------------|-----------------------------|
| Junction to Ambient | TO-220F/TO-220F1 TO-220F2/TO-262 TO-263 | θ_{JA} | 62.5 | $^{\circ}\text{C}/\text{W}$ |
| | TO-251/TO-252 | | 110 | $^{\circ}\text{C}/\text{W}$ |
| | TO-220F/TO-220F1 TO-220F2 | | 3.57 | $^{\circ}\text{C}/\text{W}$ |
| Junction to Case | TO-251/TO-252 | θ_{JC} | 2.6 (Note) | $^{\circ}\text{C}/\text{W}$ |
| | TO-262/TO-263 | | 1 | $^{\circ}\text{C}/\text{W}$ |

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

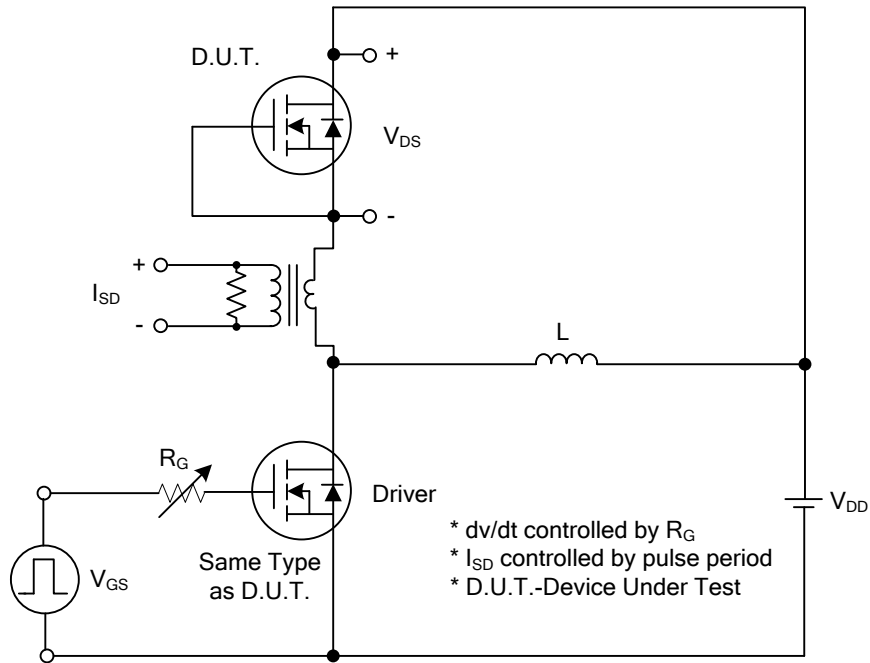
■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|--------------|---|-----|-----|-----|----------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 650 | | | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 10 | μA |
| Gate- Source Leakage Current | Forward | $V_{GS}=30V, V_{DS}=0V$ | | | 100 | nA |
| | Reverse | | | | | |
| ON CHARACTERISTICS | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=3.5A$ | | | 1.3 | Ω |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=25V, V_{GS}=0V, f=1.0\text{MHz}$ | | 870 | | pF |
| Output Capacitance | C_{OSS} | | | 97 | | pF |
| Reverse Transfer Capacitance | C_{RSS} | | | 9.6 | | pF |
| SWITCHING CHARACTERISTICS | | | | | | |
| Total Gate Charge (Note 1) | Q_G | $V_{DS}=520V, V_{GS}=10V, I_D=7A$ $I_G=1\text{mA}$ (Note 1, 2) | | 22 | | nC |
| Gate-Source Charge | Q_{GS} | | | 5 | | nC |
| Gate-Drain Charge | Q_{GD} | | | 5.5 | | nC |
| Turn-On Delay Time (Note 1) | $t_{D(ON)}$ | $V_{DS}=100V, V_{GS}=10V, I_D=7A,$ $R_G=25\Omega$ (Note 1, 2) | | 12 | | ns |
| Turn-On Rise Time | t_R | | | 20 | | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ | | | 74 | | ns |
| Turn-Off Fall Time | t_F | | | 33 | | ns |
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS | | | | | | |
| Maximum Body-Diode Continuous Current | I_S | | | | 7 | A |
| Maximum Body-Diode Pulsed Current | I_{SM} | | | | 14 | A |
| Drain-Source Diode Forward Voltage (Note 1) | V_{SD} | $I_S=7A, V_{GS}=0V$ | | | 1.4 | V |
| Reverse Recovery Time (Note 1) | t_{rr} | $I_S=7A, V_{GS}=0V$ $di/dt=100A/\mu s$ | | 506 | | ns |
| Reverse Recovery Charge | Q_{rr} | | | 2.7 | | μC |

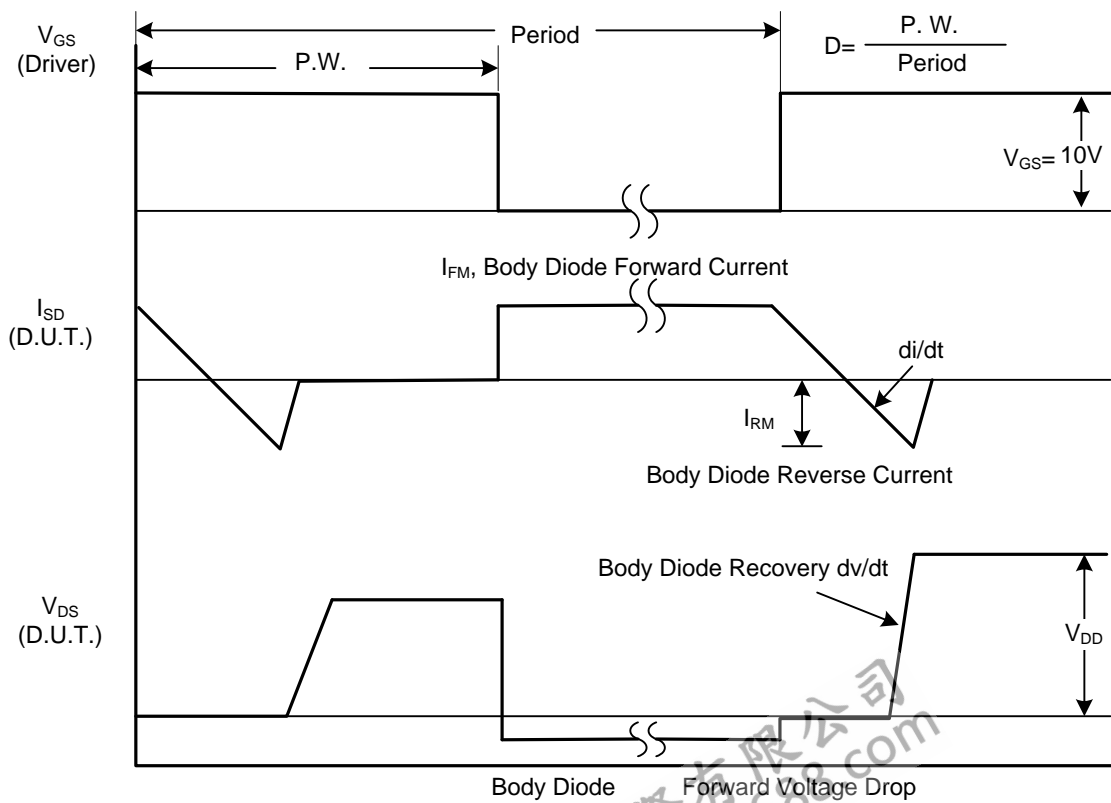
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

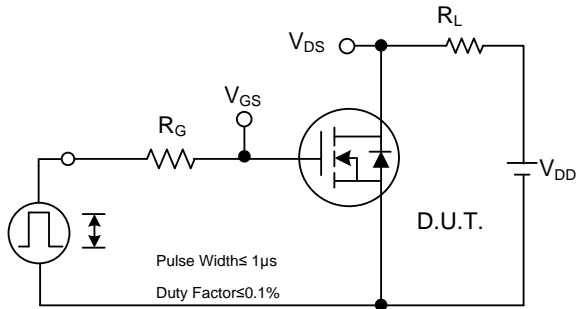


Peak Diode Recovery dv/dt Test Circuit

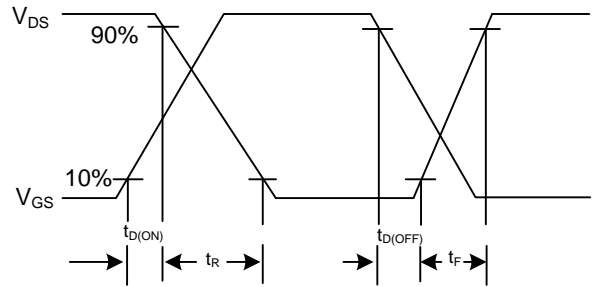


Peak Diode Recovery dv/dt Waveforms

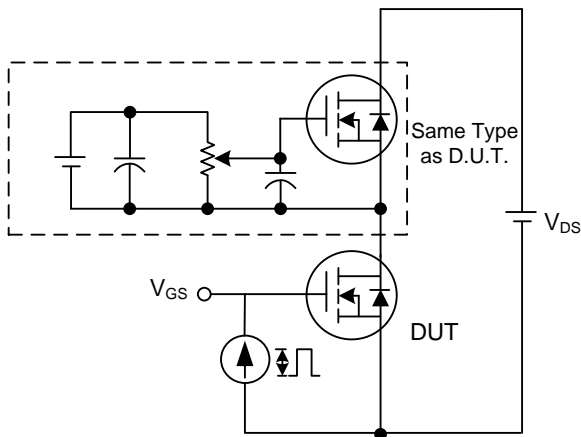
■ TEST CIRCUITS AND WAVEFORMS



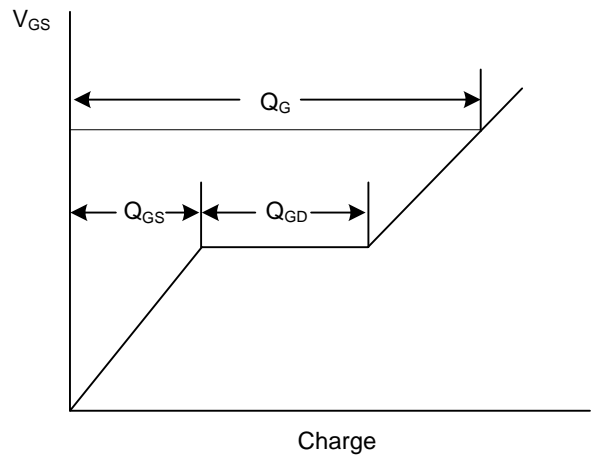
Switching Test Circuit



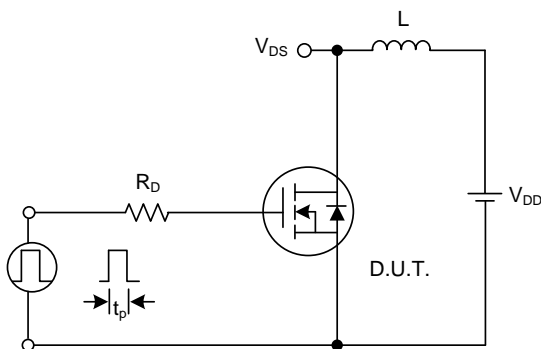
Switching Waveforms



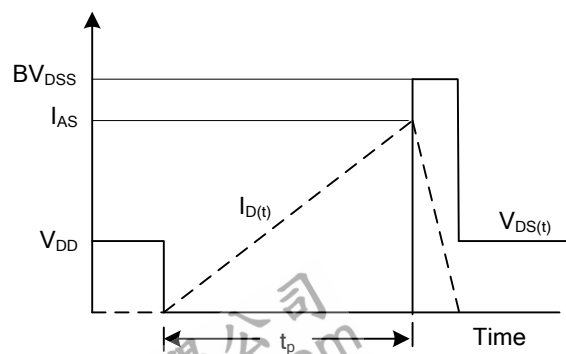
Gate Charge Test Circuit



Gate Charge Waveform

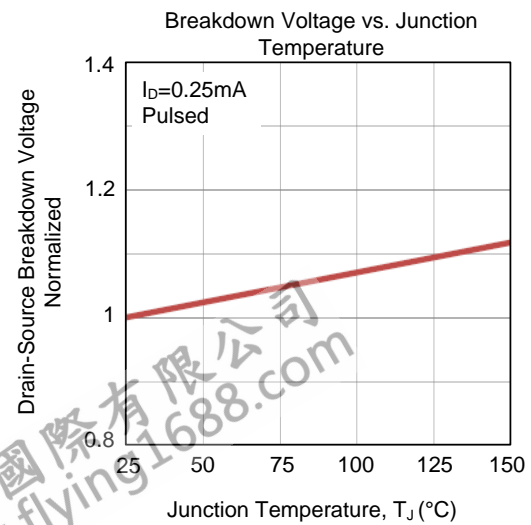
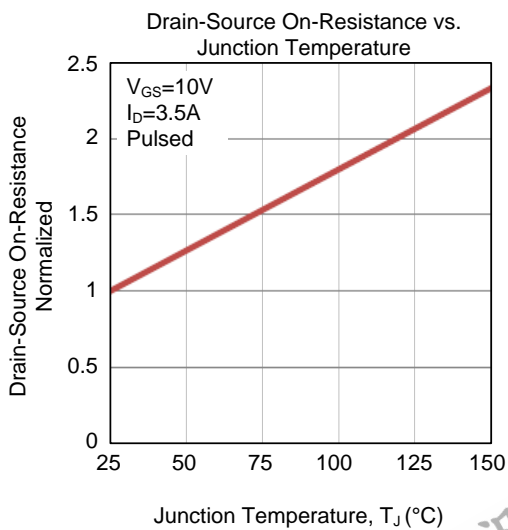
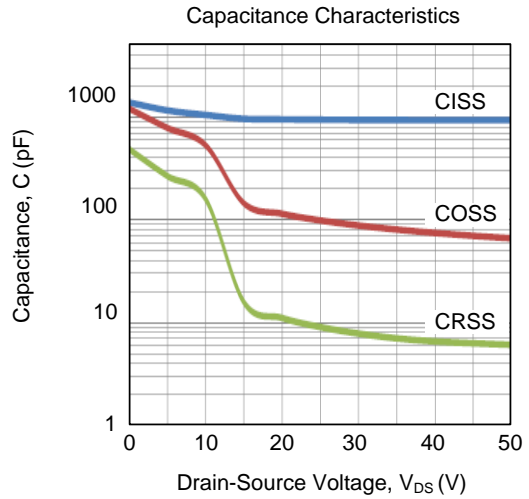
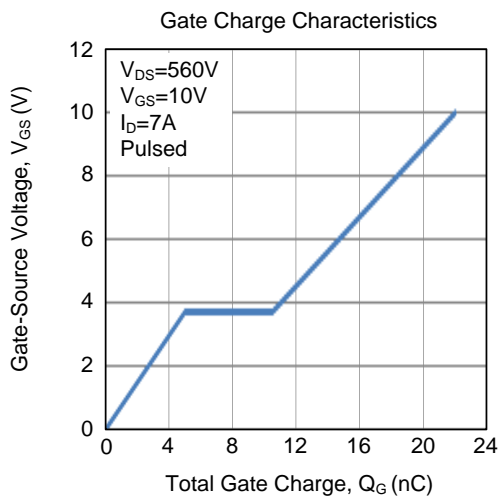
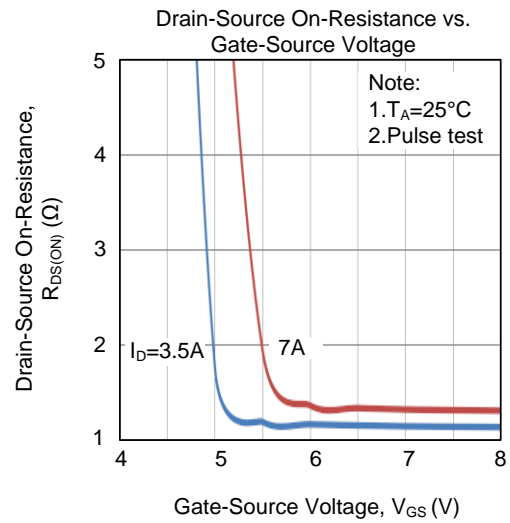
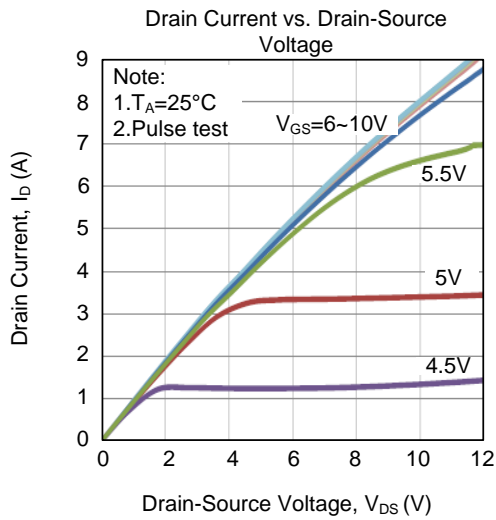


Unclamped Inductive Switching Test Circuit

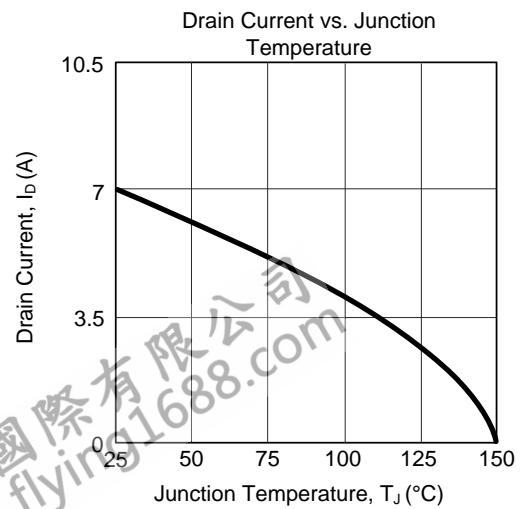
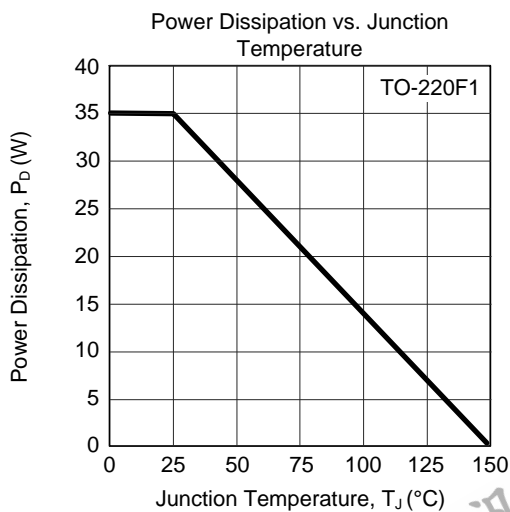
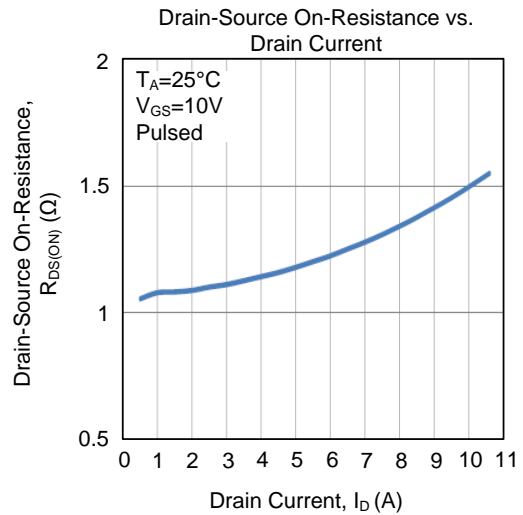
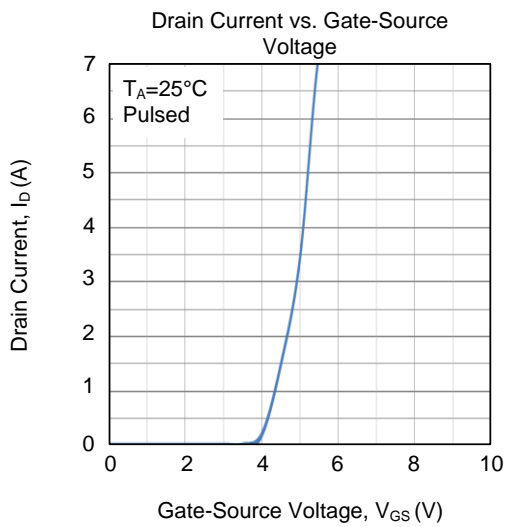
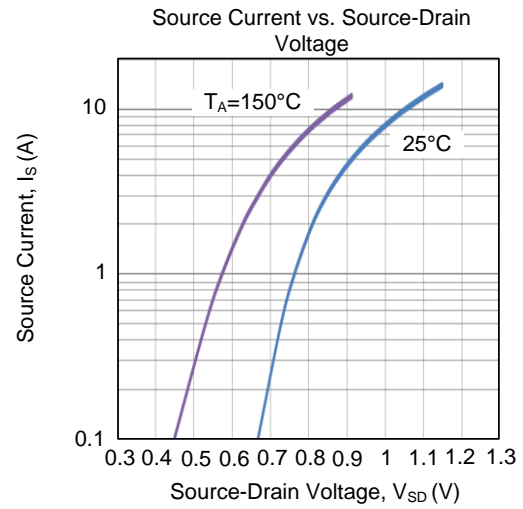
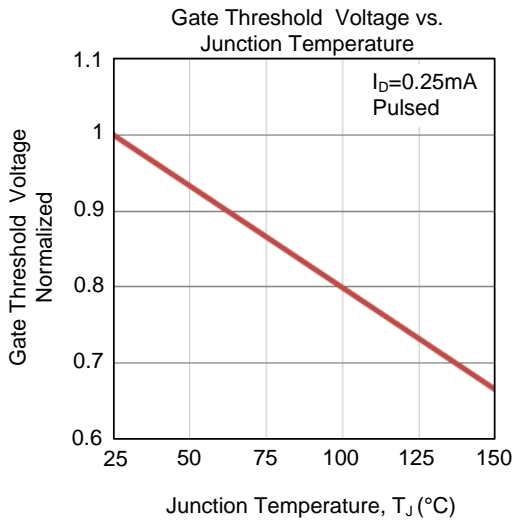


Unclamped Inductive Switching Waveforms

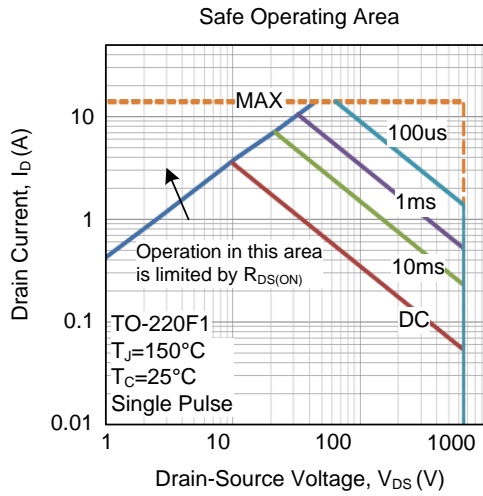
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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